Claims

1. A method for scheduling at least one out of K transmission channels $k=1,..,K$ with respective $N_{t,k}$ transmission interfaces and respective $N_{r,k}$ reception interfaces for the transmission of data symbols modulated according to a non-orthonormal matrix modulation that modulates data symbols in both a non-orthogonal spatial domain and at least one orthogonal domain, wherein at least one Equivalent Channel Matrix (ECM) G_k can be defined that transforms said data symbols into data symbols that have been matrix modulated, transmitted over $N_{t,k}$ transmission interfaces and received at $N_{r,k}$ reception interfaces of one of said transmission channels $k=1,..,K$, and wherein an Equivalent Channel Correlation Matrix (ECCM) $R_k = G_k^H \cdot G_k$ of said at least one ECM G_k is not proportional to the identity matrix, said method comprising:

- calculating a respective Channel Quality Indicator (CQI) q_k for at least one of said K transmission channels, and
- scheduling at least one of said K transmission channels for the transmission of said matrix modulated data symbols, wherein said scheduling is at least partially based on said calculated CQIs q_k.

2. The method according to claim 1, wherein said respective CQI q_k is derived for at least one of said K transmission channels from said ECCM R_k.

3. The method according to claim 2, wherein said respective CQI q_k is calculated for at least one of said K transmission channels as a function of the determinant of a linear function of said ECCM R_k.

4. The method according to claim 2, wherein said respective CQI q_k is calculated for at least one of said K transmission channels as a function of the trace of said ECCM R_k.

5. The method according to claim 2, wherein said respective CQI q_k is calculated for at least one of said K transmission channels as a function of the trace of the inverse of said ECCM R_k.

6. The method according to claim 1, wherein said respective CQI q_k is calculated for at least one of said K transmission channels as a function of the elements of a channel matrix H_k, which defines said at least one transmission channel, and wherein said function is derived from said ECCM R_k under exploitation of the structural properties of said ECCM R_k.

7. The method according to claim 1, wherein said non-orthonormal matrix modulation is an ABBA non-orthonormal matrix modulation that maps a block of 4 data symbols onto $N_{t,k}=4$ transmission interfaces in 4 units of said at least one orthogonal domain and is based on the non-orthonormal combination of two Space-Time Transmit Diversity (STTD) codes.

8. The method according to claim 6, wherein said ECCM R_k is of the form

$$R_k = \begin{bmatrix} p_k & 0 & n_k & 0 \\ 0 & p_k & 0 & n_k \\ n_k & 0 & p_k & 0 \\ 0 & n_k & 0 & p_k \end{bmatrix}, \text{ and}$$

wherein p_k and n_k are real-valued functions of the elements of said channel matrix H_k.

9. The method according to claim 8, wherein said respective CQI q_k is calculated for at least one of said K transmission channels as a function of $\left((a+p_k)^2 - n_k^2\right)^2$, and wherein a is a constant value.

10. The method according to claim 1, wherein said non-orthonormal matrix modulation is a DABBA non-orthonormal matrix modulation that maps a block of 8 data symbols onto $N_{t,k}=4$ transmission interfaces in 4 units of said at least one orthogonal domain and is based on the non-orthonormal combination of four Space-Time Transmit Diversity (STTD) codes.

11. The method according to claim 6, wherein said ECCM R_k is of the form

$$R_k = \begin{bmatrix} p_{k,1}+p_{k,2} & 0 & n_{k,1} & 0 & p_{k,1}-p_{k,2} & 0 & i\cdot n_{k,2} & s_k^* \\ 0 & p_{k,1}+p_{k,2} & 0 & n_{k,1} & 0 & p_{k,1}-p_{k,2} & -s_k & i\cdot n_{k,2} \\ n_{k,1} & 0 & p_{k,1}+p_{k,2} & 0 & i\cdot n_{k,2} & -s_k^* & -p_{k,1}+p_{k,2} & 0 \\ 0 & n_{k,1} & 0 & p_{k,1}+p_{k,2} & s_k & i\cdot n_{k,2} & 0 & -p_{k,1}+p_{k,2} \\ p_{k,1}-p_{k,2} & 0 & i\cdot n_{k,2} & s_k^* & p_{k,1}+p_{k,2} & 0 & n_{k,1} & 0 \\ 0 & p_{k,1}-p_{k,2} & -s_k & i\cdot n_{k,2} & 0 & p_{k,1}+p_{k,2} & 0 & n_{k,1} \\ i\cdot n_{k,2} & -s_k^* & -p_{k,1}+p_{k,2} & 0 & n_{k,1} & 0 & p_{k,1}+p_{k,2} & 0 \\ s & i\cdot n_{k,2} & 0 & -p_{k,1}+p_{k,2} & 0 & n_{k,1} & 0 & p_{k,1}+p_{k,2} \end{bmatrix}$$

wherein $p_{k,1}$, $p_{k,2}$, $n_{k,1}$ and $n_{k,2}$ are real-valued functions of the elements of said channel matrix H_k and wherein s_k is a complex-valued function of the elements of said channel matrix H_k.

12. The method according to claim 11, wherein said respective CQI q_k is calculated for at least one of said K transmission channels as a function of $\left(4 \cdot p_{k,1} \cdot p_{k,2} + (p_{k,1} + p_{k,2})(a^2 + 2 \cdot a) + n_{k,1}^2 - n_{k,2}^2 + |s_k|^2\right)^4$, and wherein a is a constant value.

13. The method according to claim 1, wherein said non-orthonormal matrix modulation is a TSTTD non-orthonormal matrix modulation that maps a block of 4 data symbols onto $N_{t,k}=2$ transmission interfaces in *2* units of said at least one orthogonal domain and is based on the non-orthonormal combination of two STTD codes.

14. The method according to claim 6, wherein said ECCM R_k is of the form

$$R_k = \begin{bmatrix} p_{k,1} + p_{k,2} & 0 & p_{k,1} - p_{k,2} & s_k \\ 0 & p_{k,1} + p_{k,2} & s_k^* & p_{k,2} - p_{k,1} \\ p_{k,1} - p_{k,2} & s_k & p_{k,1} + p_{k,2} & 0 \\ s_k^* & p_{k,2} - p_{k,1} & 0 & p_{k,1} + p_{k,2} \end{bmatrix},$$

wherein $p_{k,1}$ and $p_{k,2}$ are real-valued functions of the elements of said channel matrix H_k and wherein s_k is a complex-valued function of the elements of said channel matrix H_k.

15. The method according to claim 14, wherein said respective CQI q_k is calculated for at least one of said K transmission channels as a function of $\left(\det(aI + H_k^H H_k)\right)$, and wherein a is a constant value.

16. The method according to claim 1, wherein said non-orthonormal matrix modulation is a DSTTD non-orthonormal matrix modulation that maps a block of 4

data symbols onto $N_{t,k}=4$ transmission interfaces in 2 units of said at least one orthogonal domain and is based on the non-orthonormal combination of two STTD codes.

17. The method according to claim 1, wherein said non-orthonormal matrix modulation comprises space-time or space-frequency coding.

18. The method according to claim 1, wherein said non-orthonormal matrix modulation comprises a combination of at least two orthonormal matrix modulations.

19. A method for scheduling at least one out of K transmission channels $k=1,..,K$ with respective $N_{t,k}$ transmission interfaces and respective $N_{r,k}$ reception interfaces for the transmission of data symbols, wherein at least two of said data symbols are transmitted in parallel from $N_{t,k}$ transmission interfaces of at least one of said K transmission channels, which is defined by a channel matrix H_k, said method comprising:

- calculating a respective Channel Quality Indicator (CQI) q_k for at least one of said K transmission channels, wherein at least one of said respective CQIs q_k is calculated as a function of the determinant of a linear function of a channel correlation matrix $H_k^H \cdot H_k$ of said channel matrix H_k, and
- scheduling at least one of said K transmission channels for the transmission of said data symbols, wherein said scheduling is at least partially based on said calculated CQIs q_k.

20. The method according to any of the claims 1 and 19, wherein at least one receiver uses a Maximum Likelihood algorithm or a linear estimator to estimate said data symbols that are transmitted over said scheduled transmission channel and received by said receiver via said reception interfaces of said scheduled transmission channel.

21. The method according to any of the claims 1 and 19, wherein a transmission channel $k=1,..,K$ with the largest CQI q_k is scheduled for said transmission of said data symbols.

22. The method according to claim 1, wherein said transmission channels are transmission channels of a wireless communication system, and wherein said transmission and reception interfaces of said transmission channels are the transmit and receive antenna elements of one or several transmitters and one or several receivers, respectively.

23. A computer program with instructions operable to cause a processor to perform the method steps of any of the claims 1 and 19.

24. A computer program product comprising a computer program with instructions operable to cause a processor to perform the method steps of any of the claims 1 and 19.

25. A device for scheduling at least one out of K transmission channels $k=1,..,K$ with respective $N_{t,k}$ transmission interfaces and respective $N_{r,k}$ reception interfaces for the transmission of data symbols

modulated according to a non-orthonormal matrix modulation that modulates data symbols in both a non-orthogonal spatial domain and at least one orthogonal domain, wherein at least one Equivalent Channel Matrix (ECM) G_k can be defined that transforms said data symbols into data symbols that have been matrix modulated, transmitted over $N_{t,k}$ transmission interfaces and received at $N_{r,k}$ reception interfaces of one of said transmission channels $k=1,..,K$, and wherein an Equivalent Channel Correlation Matrix (ECCM) $R_k = G_k^H \cdot G_k$ of said at least one ECM G_k is not proportional to the identity matrix, said device comprising:

- means for calculating a respective Channel Quality Indicator (CQI) q_k for at least one of said K transmission channels, and
- means for scheduling at least one of said K transmission channels for the transmission of said matrix modulated data symbols, wherein said scheduling is at least partially based on said calculated CQIs q_k.

26. A transmitting station in a wireless communication system that schedules at least one out of K transmission channels $k=1,..,K$ with respective $N_{t,k}$ transmission interfaces and respective $N_{r,k}$ reception interfaces for the transmission of data symbols modulated according to a non-orthonormal matrix modulation that modulates data symbols in both a non-orthogonal spatial domain and at least one orthogonal domain, wherein at least one Equivalent Channel Matrix (ECM) G_k can be defined that transforms said data symbols into data symbols that have been matrix modulated, transmitted over $N_{t,k}$ transmission interfaces and received at $N_{r,k}$ reception interfaces of one of said transmission channels $k=1,..,K$, and wherein an

Equivalent Channel Correlation Matrix (ECCM) $R_k = G_k^H \cdot G_k$ of said at least one ECM G_k is not proportional to the identity matrix , said transmitting station comprising:

- means for calculating a respective Channel Quality Indicator (CQI) q_k for at least one of said K transmission channels, and
- means for scheduling at least one of said K transmission channels for the transmission of said matrix modulated data symbols, wherein said scheduling is at least partially based on said calculated CQIs q_k.

27. A wireless communication system, comprising:

- at least one transmitting station, and
- at least one receiving station,

wherein a non-orthonormal matrix modulation modulates data symbols in both a non-orthogonal spatial domain and at least one orthogonal domain, wherein said matrix modulated data symbols are transmitted over at least one out of K transmission channels $k=1,..,K$ with respective $N_{t,k}$ transmission interfaces and respective $N_{r,k}$ reception interfaces, wherein at least one Equivalent Channel Matrix (ECM) G_k can be defined that transforms said data symbols into data symbols that have been matrix modulated, transmitted over $N_{t,k}$ transmission interfaces and received at $N_{r,k}$ reception interfaces of one of said transmission channels $k=1,..,K$, wherein an Equivalent Channel Correlation Matrix (ECCM) $R_k = G_k^H \cdot G_k$ of said at least one ECM G_k is not proportional to the identity matrix, wherein said at least one transmitting station calculates a respective Channel Quality Indicator (CQI) q_k for at least one of said K transmission channels, and schedules at least one of said K transmission channels

for the transmission of said matrix modulated data symbols, wherein said scheduling is at least partially based on said calculated CQIs q_k.

28. A device for scheduling at least one out of K transmission channels $k=1,..,K$ with respective $N_{t,k}$ transmission interfaces and respective $N_{r,k}$ reception interfaces for the transmission of data symbols, wherein at least two of said data symbols are transmitted in parallel from $N_{t,k}$ transmission interfaces of at least one of said K transmission channels, which is defined by a channel matrix H_k, said device comprising:

- means for calculating a respective Channel Quality Indicator (CQI) q_k for at least one of said K transmission channels, wherein at least one of said respective CQIs q_k is calculated as a function of the determinant of a linear function of a channel correlation matrix $H_k^H \cdot H_k$ of said channel matrix H_k, and
- means for scheduling at least one of said K transmission channels for the transmission of said data symbols, wherein said scheduling is at least partially based on said calculated CQIs q_k.

29. A transmitting station that schedules at least one out of K transmission channels $k=1,..,K$ with respective $N_{t,k}$ transmission interfaces and respective $N_{r,k}$ reception interfaces for the transmission of data symbols, wherein at least two of said data symbols are transmitted in parallel from $N_{t,k}$ transmission interfaces of at least one of said K transmission channels, which is defined by a channel matrix H_k, said transmitting station comprising:

- means for calculating a respective Channel Quality Indicator (CQI) q_k for at least one of said K transmission channels, wherein at least one of said respective CQIs q_k is calculated as a function of the determinant of a linear function of a channel correlation matrix $H_k^H \cdot H_k$ of said channel matrix H_k, and
- means for scheduling at least one of said K transmission channels for the transmission of said data symbols, wherein said scheduling is at least partially based on said calculated CQIs q_k.

30. A wireless communication system, comprising

- at least one transmitting station, and
- at least one receiving station,

wherein at least two data symbols are transmitted in parallel from $N_{t,k}$ transmission interfaces of at least one out of K transmission channels with $N_{t,k}$ transmission interfaces and $N_{r,k}$ reception interfaces, wherein said at least one transmission channel is defined by a channel matrix H_k, wherein said transmitting station calculates a respective Channel Quality Indicator (CQI) q_k for at least one of said K transmission channels, wherein said transmitting station calculates at least one of said respective CQIs q_k as a function of the determinant of a linear function of a channel correlation matrix $H_k^H \cdot H_k$ of said channel matrix H_k, wherein said at least one transmitting station schedules at least one of said K transmission channels for the transmission of said data symbols, and wherein said scheduling is at least partially based on said calculated CQIs q_k.